MAYO CLINIC LABORATORIES

Test Definition: CCP

Cyclic Citrullinated Peptide Antibodies, IgG, Serum

Overview

Useful For

Evaluating patients suspected of having rheumatoid arthritis (RA)

Differentiating RA from other inflammatory arthritis or connective tissue diseases

Testing Algorithm

For more information see:

-Connective Tissue Disease Cascade

-Acquired Neuropathy Diagnostic Algorithm

Special Instructions

- Connective Tissue Disease Cascade
- Acquired Neuropathy Diagnostic Algorithm

Method Name

Enzyme-Linked Immunosorbent Assay (ELISA)

NY State Available

Yes

Specimen

Specimen Type

Serum

Specimen Required

Collection Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Submission Container/Tube: Plastic vial

Specimen Volume: 0.5 mL

Collection Instructions: Centrifuge and aliquot serum into a plastic vial.

Forms

If not ordering electronically, complete, print, and send a General Request (T239) with the specimen.

Specimen Minimum Volume

0.4 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	Reject
Gross icterus	OK
Heat-treated specimen	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	21 days	
	Frozen	21 days	

Clinical & Interpretive

Clinical Information

Rheumatoid arthritis (RA) is a chronic systemic autoimmune disease characterized by interactions between the environment, specific genetic risk factors, and the human immune system. It affects about 0.6% of the US population with a global prevalence of 0.24%.(1) Clinically, RA is typified by progressive damage of synovial joints, inflammation, production of diverse autoantibodies, and variable extra-articular manifestations.(2-4) Patients with RA may be categorized based on the phase of disease (early versus established), presence or absence of antibodies (seropositive versus seronegative), clinical manifestations (joint erosion, interstitial lung disease, or cardiovascular), or specific risks (genes, gender, or smoking).(2-4) Delayed diagnosis of RA is associated with joint erosion, destruction or deformities, poor response to treatment with an ultimate increase in morbidity, and mortality.(3,4)

Although late RA diagnosis may be linked to adverse consequences, early diagnosis has been reported to improve outcomes; notably reduced joint destruction or deformity, delayed radiologic progression, and decreased functional disability.(3-5) To facilitate early diagnosis, the American College of Rheumatology/European League Against Rheumatism 2010 RA classification criteria recommend testing for rheumatoid factor (RF) and anticitrullinated protein antibodies (ACPA).(2) RF is an autoantibody directed against the Fc portion of immunoglobulin while ACPA are directed against peptides and proteins containing citrulline, a modified form of the amino acid arginine.(6,7) In addition to the use of RA and ACPA IgG to diagnose RA, RF and ACPA isotype antibodies and other serologic biomarkers have been used to predict if, and when, an individual who has inflammatory arthritis (IA) may develop future clinically apparent IA and access genetic and/or environmental risks.(3,4,8,9)

Compared to early serologic tests for RA including RF, several studies have demonstrated that ACPA have much improved specificity for RA.(4,6,10) A systemic review and meta-analysis of 33 studies including patients with RA and healthy or disease controls demonstrated the sensitivity of anti-mutated citrullinated vimentin, anticyclic citrullinated peptide, and RF of 71%, 71%, 77%, with the specificity of 89%, 95%, 73%, and the area under the curve of the summary receiver operating characteristic of 89%, 95%, 82%, respectively.(10) Based on these studies, there exist a subset of

patients with RA who are negative for RF and ACPA IgG (seronegative) who must be diagnosed clinically or with use of emerging diagnostic tests.(4,7,9)

For more information see Connective Tissue Disease Cascade.

Reference Values

<20.0 U (negative)
20.0-39.9 U (weak positive)
40.0-59.9 U (positive)
> or =60.0 U (strong positive)
Reference values apply to all ages.

Interpretation

A positive result for cyclic citrullinated peptide (CCP) antibodies may be suggestive of rheumatoid arthritis (RA) if compatible clinical features of disease are present.

Significantly elevated levels of CCP antibodies may be useful to identify RA patients with erosive joint disease.

A Mayo Clinic prospective clinical evaluation of the CCP antibody test showed a diagnostic sensitivity for RA of 78% with fewer than 5% false positive results in healthy controls (see Cautions).

Cautions

Positive results for cyclic citrullinated peptide (CCP) antibodies may occur in some patients with systemic lupus erythematosus or other autoimmune, connective tissue diseases. In a Mayo Clinic study (see Interpretation), the false-positive rate in this subgroup was approximately 10%.

Antirheumatic therapy should not be initiated based solely on a positive test for CCP antibodies, and changes in treatment should not be based upon the levels of CCP antibodies.

Clinical Reference

1. Cross M, Smith E, Hoy D, et al. The global burden of rheumatoid arthritis: estimates from the global burden of disease 2010 study. Ann Rheum Dis. 2014;73(7):1316-1322
2. Aletaha D, Neogi T, Silman AJ, et al. 2010 Rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. Arthritis Rheum. 2010;62(9):2569-2581
3. Burgers LE, Raza K, van der Helm-van Mil AH. Window of opportunity in rheumatoid arthritis - definitions and supporting evidence: from old to new perspectives. RMD Open. 2019;5(1):e000870
4. Deane KD, Holers VM. Rheumatoid arthritis pathogenesis, prediction, and prevention: An emerging paradigm shift. Arthritis Rheumatol. 2021;73(2):181-193
5. Emery P, Breedveld FC, Dougados M, Kalden JR, Schiff MH, Smolen JS. Early referral recommendation for newly diagnosed rheumatoid arthritis: evidence based development of a clinical guide. Ann Rheum Dis. 2002;61(4):290-297
6. Schellekens GA, Visser H, de Jong BA, et al. The diagnostic properties of rheumatoid arthritis antibodies recognizing a cyclic citrullinated peptide. Arthritis Rheum. 2000;43(1):155-163
7. Derksen VFAM, Huizinga TWJ, van der Woude D. The role of autoantibodies in the pathophysiology of rheumatoid arthritis. Semin Immunopathol. 2017;39(4):437-446
8. Hedstrom AK, Ronnelid J, Klareskog L, Alfredsson L. Complex relationships of smoking, HLA-DRB1 genes, and serologic

profiles in patients with early rheumatoid arthritis: Update from a Swedish population-based case-control study. Arthritis Rheumatol. 2019;71(9):1504-1511
9. Verheul MK, Bohringer S, van Delft MAM, et al. Triple positivity for anti-citrullinated protein autoantibodies, rheumatoid factor, and anti-carbamylated protein antibodies conferring high specificity for rheumatoid arthritis: Implications for very early identification of at-risk individuals. Arthritis Rheumatol. 2018;70(11):1721-1731
10. Zhu JN, Nie LY, Lu XY, Wu HX. Meta-analysis: compared with anti-CCP and rheumatoid factor, could anti-MCV be the next biomarker in the rheumatoid arthritis classification criteria? Clin Chem Lab Med. 2019;57(11):1668-1679

Performance

Method Description

Cyclic citrullinated peptide (CCP) antibodies in serum are detected by binding to the wells of a commercial microtiter plate coated with synthetic CCP. During the first incubation, serum antibodies bind to adsorbed, solid phase CCP. The wells are then washed to remove unbound serum constituents, and horse radish peroxidase-labeled goat anti-human IgG antibody is added. After further incubation and washing to remove unbound conjugate, substrate (3,3',5,5' tetramethylbenzidine) is added and allowed to incubate. The reaction between enzyme and substrate is stopped and color in the wells is measured in a microtiter plate reader. The concentration of CCP antibodies is determined by comparison to a 5-point standard curve (15.6-250 U). Testing is performed on the Agility instrument by Dynex.(Package insert: Quanta Lite CCP3 IgG ELISA. INOVA Diagnostics; 02/2020)

PDF Report

No

Day(s) Performed

Monday through Saturday

Report Available

Same day/1 to 3 days

Specimen Retention Time

14 days

Performing Laboratory Location

Rochester

Fees & Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

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Test Definition: CCP

Cyclic Citrullinated Peptide Antibodies, IgG, Serum

Test Classification

This test has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information

86200

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
CCP	Cyclic Citrullinated Peptide Ab, S	33935-8

Result ID	Test Result Name	Result LOINC® Value
CCP	Cyclic Citrullinated Peptide Ab, S	33935-8